

Proposal to Lead the Virtual Center on Carbon Materials, and support the Chemical Hydrides Center

We plan to organize a team of dedicated and capable individuals to address the key challenges associated with using carbon materials as hydrogen adsorbents on-board vehicles.

Among these challenges are:

The development of methods to prepare materials with > 7 wt% H storage repeatedly, and the distribution of these materials to others for verification by a variety of different methods.

The effort will be goal-focused with essential contributions.

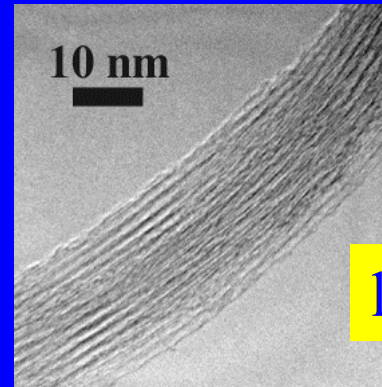
- In the form of unique expertise/capability
- Supplementary and complementary participants
- Collaborative environment to address all programmatic goals



NREL Capabilities in Carbon Materials

Growth and purification of nanoscale carbons, SWNTs, MWNTs by laser vaporization, chemical vapor deposition, hot wire CVD, and arc-discharge methods. Experience with dopant and/or catalyst incorporation

CVD



laser

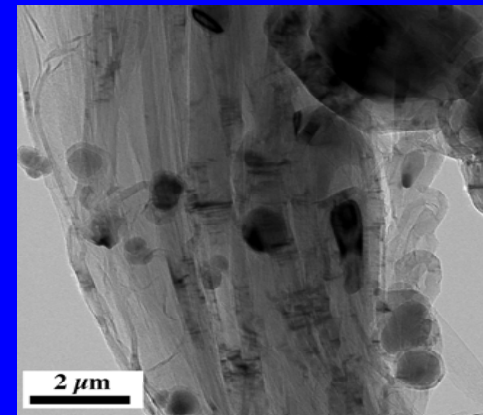
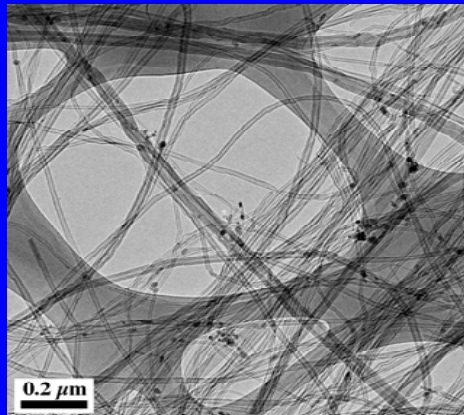
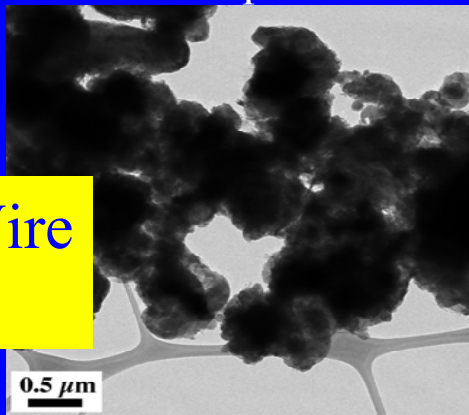


Room Temperature

400 - 600 °C

> 800 °C

Hot Wire
CVD



Amorphous Carbon

Carbon MWNTs

Large Graphitic Particles

Capabilities in Carbon/Hydrogen Characterization

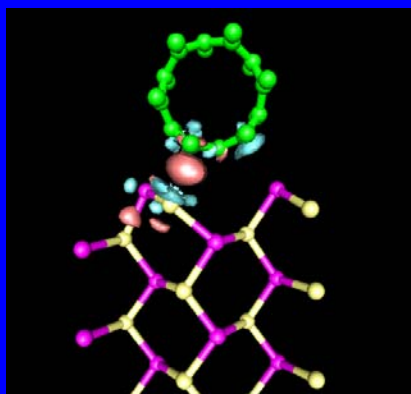
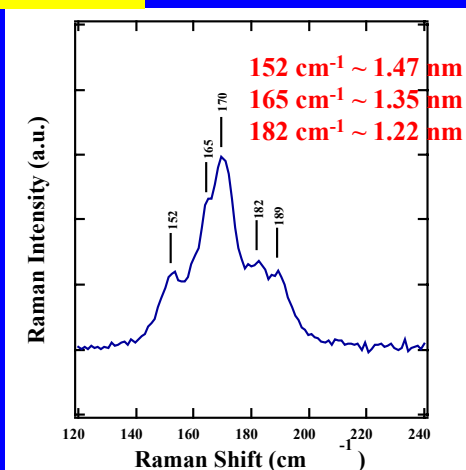
Ten years of experience - Integrated team of chemical engineers, chemists, materials scientists, physicists.

Custom instrumentation designed specifically for accurate H capacity measurements on research quantities. Validated by calibration by Honda and R. Chahine at UQTR.

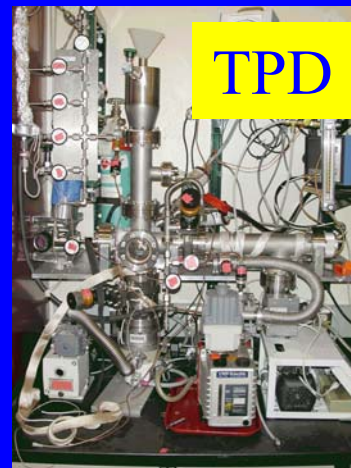
Structural / theoretical characterization tools:

Multi-color Raman, photoluminescence, TEM, EDS, ICP, XRD, ICP, TGA, AFM, NMR, ESR

Raman



First principles,
DFT



TPD



volumetric

Management Plan for Carbon Center & Linkages

We plan to develop a well-organized, goal driven management plan for the Center

The Center will be focused on developing systems that meet kinetics, volumetric and gravimetric capacity, impurity tolerance, safety, and cost targets. A strong techno-economic component will be included

We will build on two existing Office of Science programs on carbon nanotubes at NREL

We will link to both the Carbon Materials Working Group and IEA Annex 17

Measurement and Characterization capabilities with research quantities of materials enable support of Advanced Concepts

If interested in participating, please contact Mike Heben:

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Supporting a Virtual Center on Chemical Hydrides

Innovative process for production and recycling of NaBH_4 directly from H_2 (Proposed - working with MCEL and US Borax)

Analysis of heat and water balance for release of H_2 from NaBH_4 (with MCEL and Daimler-Chrysler)

Preparation, thermo- and electro-chemistry, and catalysis by transition metal hydride complexes (funded by DOE BES)

Lead DOE lab for new SiH_4 production process – pilot plant being designed to be constructed and operated by the partners in the FSU (Stage 2, funded by DOE IPP Program)

Broad capability for economic and life cycle analysis for H_2 production and storage processes (funded by EERE)

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